

Methods, Systems and Apparatuses for Retrieving an Entity from a Confined Space

RELATED APPLICATION DATA

This application claims priority to provisional application number 60/454,292, filed on March 12, 2003.

FIELD OF THE INVENTION

This invention relates to methods, systems, and apparatuses for retrieving an entity from a confined space, such as a transportable storage vessel, a portable liquid storage tank, a cargo transport container, or any type of storage vessel.

BACKGROUND

Portable liquid storage vessels are commonly used in a number of industrial applications. For example, portable liquid storage tanks may be used to transport acids, chemicals, juices, milk, water, asphalt, crude oil, petroleum products, or any other liquids or liquid products used in industrial applications. Storage vessels are needed for use at oil well drilling sites, construction sites, fire fighting locations, and in situ chemical processing operations. Such storage vessels are also used for temporary on-site storage of liquids. The storage capacity of such storage vessels may range from 25 barrel tanks to 500 barrel tanks. Because some liquids, such as oil well drilling fluids, are heavy, some storage vessels are equipped with interior beams and tie rods to strengthen the sidewalls of the storage vessels.

After these storage vessels are used, the interior surfaces of the vessels must be cleaned. Storage vessels are often equipped with drain outlets; however, mere drainage of liquid from storage vessels may not adequately clean the interior surfaces of the vessels. Likewise, storage vessels may be equipped with a circulating line, which will allow stored liquid to flow and will prevent stored liquid from settling on the interior surfaces of the storage vessels. Still, circulating the liquid may not prevent stored liquids from settling on the interior surfaces of the storage vessels. If a storage vessel is equipped with internal beams and tie rods, cleaning and maintenance are extremely difficult and corrosion may become a problem. Corrosion weakens the internal beams and rods, making storage vessels and unsafe and unsuitable for transporting or storing heavy liquids. Therefore, the interior surfaces of the storage vessels must be manually cleaned.

Storage vessels or tanks may be equipped with a ladder and an 18-20 inch inspection hatch on top of the vessel, which allows an individual to enter the

vessel with a pressure washer or any other cleaning equipment. To facilitate such manual cleaning, the interior surfaces of some storage vessels may be lined with epoxy, polyethylene or any coating that will allow easy removal of liquid.

An individual's confined space entry into a storage vessel to clean the interior surfaces of the vessels may cause injury to the individual. Individuals entering storage vessels may be exposed to dangerous liquids or chemicals under high pressure, which may cause respiratory distress, eye injury, inhalation injury, skin injury or burns, or any other physical injury associated with exposure to a hazardous atmosphere. In addition, entry into a storage vessel through a mere 18-20 inch inspection hatch may cause bruises, back injury, cuts or lacerations, sprains, strains, or crushing injuries. If an individual is injured and is trapped inside of a storage vessel, the individual must be rescued.

Cranes have been used to extract personnel from confined spaces such as storage vessels. The use of a crane as a rescue method poses its own safety problems. Individuals lifted out of a confined space with a crane may sustain broken bones, sprains, strains, or the individual's body may become entangled within the internal configuration of a tank.

A tank access stand comprised of a ladder and a portable platform that would correspond to the height of the storage vessel and that could be placed beside a storage vessel has been proposed as a rescue method. A rescuer could climb the ladder and stand on the platform while lifting an individual out of a confined space, using a cable that is attached to the platform. The approximate cost of such an access stand is at least \$5000.00. Because the storage vessels are available in a variety of sizes, one access stand may not be useful for rescuing individuals from storage vessels of different heights and widths. Therefore, multiple stands of different sizes may be necessary and the use of such access stands could be costly.

What is needed is an economical method, system and apparatus for rescuing individuals trapped in a confined space.

What is also needed is a safe method, system and apparatus for rescuing individuals trapped in a confined space.

What is needed is an apparatus for rescuing individuals from a confined space that is lightweight.

Further, what is needed is a method, system, and apparatus for rescuing individuals trapped in a confined space that may be used on all types and sizes of storage vessels or tanks.

SUMMARY

Methods, systems, and apparatuses according to this invention are aimed at rescuing individuals who are trapped in confined spaces, such as transportable storage vessel, a portable liquid storage tank, a cargo transport container, or any type of storage vessel. Methods, systems, and apparatuses according to this invention provide a lightweight, safe, economical, and adaptable means of rescuing individuals trapped in confined spaces.

Methods, systems and apparatuses according to this invention use a ladder and an inexpensive adaptor mechanism that may be used with equipment that is already commonly used in industrial applications. Use of such adaptor mechanisms decreases the cost involved in manufacturing embodiments of this invention.

In a preferred embodiment of this invention, an adaptor mechanism may be mounted onto a storage vessel of any size and securely attached to a tripod, which is commonly used in the oil industry. In a preferred embodiment of this invention, a mechanical device may be attached to the tripod. Methods, systems, and apparatuses according to this invention may use mechanical devices, such as pulleys, winches, or wheels, that are equipped with a means of safely lifting an individual from a confined space. In a preferred embodiment of the invention, such lifting means may include a cable, rope, wire, cord or any other suitable tethering material capable of lifting an individual out of a confined space. In a method according to one embodiment of this invention, a tethering material may be attached to the trapped individual and the individual may be lifted out of the confined space using a mechanical device that may be attached to a tripod that is mounted on the storage vessel. According to one embodiment of this invention, the rescuer and the rescued individual may use a ladder to escape from the storage vessel.

Lightweight but durable materials, such as aluminum, may be used to construct apparatuses according to this invention. Use of such lightweight materials will allow a rescuer to easily maneuver, mount the storage vessel, and assemble a retrieval system according to this invention.

It is an object of certain aspects of this invention to provide a method, system, and apparatus for retrieving individuals trapped in confined spaces without causing injury to trapped individuals.

It is another object of certain aspects of this invention to provide a lightweight apparatus for retrieving individuals trapped in confined spaces.

It is yet another object of certain aspects of this invention to provide an apparatus for retrieving individuals trapped in confined spaces that can be easily assembled.

Another object of certain aspects of this invention is to provide a method, system, and apparatus for retrieving individuals trapped in confined spaces that can be used on storage vessels having various sizes or shapes.

Another object of certain aspects of this invention is to provide a method, system, and apparatus for retrieving individuals trapped in confined spaces without altering the storage vessels in which the individual may be trapped.

BRIEF DESCRIPTION OF DRAWINGS

Details of the embodiments of this invention are more readily understood by reference to the annexed drawings.

Figure 1 is a top view of one embodiment of the retrieval apparatus and system of the present invention.

Figure 2 is a plan view of one embodiment of the adaptor mechanism of the present invention.

Figure 3 is a plan view of one embodiment of an adjustable mount of the adaptor mechanism of the present invention.

Figure 4 is a plan view of one embodiment of an adjustable tripod pocket of the present invention.

Figure 5 is a plan view of one embodiment of ladder of the present invention.

Figure 6 is a plan view depicting the attachment of handrails to a ladder according to one embodiment of this invention.

DESCRIPTION

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Lightweight but durable materials, such as aluminum, may be used to construct apparatuses according to this invention. Use of such lightweight materials will allow a rescuer to easily maneuver, mount the storage vessel, and assemble a retrieval system according to this invention.

As shown in Figure 1, a retrieval system 10 according to one embodiment of this invention, includes a standard tripod 12, which is commonly used in industrial applications. A tripod 12 may be mounted onto a protective frame of a storage vessel 14, such as a tank, using an adaptor mechanism 16 according to one embodiment of this invention. In one embodiment of this invention, a mechanical device that may lift an individual out of a confined space may be attached to a tripod 12.

In a preferred embodiment of this invention, the mechanical device may be comprised of a winch 18, a tethering material 20, a hook 22, and a pulley 24. A winch 18 may be mounted in any suitable position on the tripod 12, and the winch 18 may be connected to a tethering material 20, such as a rope, cable, cord, or wire, that has a hook 22 on its free end. According to one embodiment of this invention, the tethering material 20 may pass through a pulley 24.

According to one embodiment of this invention, an adaptor mechanism 16 may be comprised of a member adapted to be secured to a protective frame of a storage vessel 14. As shown in Figures 1 and 2, an adaptor mechanism 16 according to one embodiment of this invention may be comprised of at least two hollow, elongated structures adapted to be secured on a protective frame 26 of a storage vessel 14. According to one embodiment of this invention, each elongated structure may be comprised of aluminum of any suitable size or shape. In a preferred embodiment, each hollow, elongated structure is comprised of

aluminum that is eighty-eight inches long, square-shaped in cross-section, and having cross-sectional dimensions of 2" x 2" x 1/8".

In one embodiment of this invention, an adaptor mechanism 16 may be equipped with at least one structure adapted to secure the adaptor mechanism 16 to a protective frame of a storage vessel 14. As shown in Figures 2 and 3, in a preferred embodiment of this invention, an adaptor mechanism 16 may be equipped with two adjustable mounts 28, on each hollow elongated structure. According to one embodiment of this invention, the adjustable mounts 28 allow the adaptor mechanism to be secured to a protective frame 26 on a storage vessel 14, as depicted in Figure 1.

As shown in Figure 3, an adjustable mount 28 according to one embodiment of this invention may be comprised of an angled base 30, a channel 32 extending from one side of the angled base 30, and a bolt 34 adapted to be inserted into the channel 32. In one embodiment of this invention, the angled base 30 of the adjustable mount 28 may be an angle of any suitable degree made of aluminum. In one embodiment of this invention, the angled base 30 is an aluminum ninety-degree angle of any size. In a preferred embodiment of this invention, the angled base 30 is an aluminum ninety-degree angle having cross-sectional dimensions of 3" x 3" x 1/4".

In one embodiment of this invention, a channel 32 may protrude from the one side of the angled base 30. According to one embodiment of this invention, a channel 32 is adapted to allow a hollow elongated structure of an adaptor mechanism 16 to pass therethrough. As shown in Figure 3, in a preferred embodiment of this invention, a channel 32 may consist of an aluminum U-shaped structure having three straight sides in cross-section, which will accommodate an adaptor mechanism 16 having hollow, elongated structures that are square-shaped in cross-section. In one embodiment of this invention, at least one side of the channel 32 is adapted to allow the insertion of a bolt 34 into the channel 32.

As shown in Figure 3, a bolt 34 may be inserted into the channel 32 until the bolt 34 contacts a hollow, elongated structure of an adaptor mechanism 16 that passes through the channel 32. The bolt 34 thereby secures the adaptor mechanism 16 to the protective frame of a storage vessel 14. In one embodiment of this invention, the bolt 34 may be T-shaped, as shown in Figure 3, having a stem 38 and a rod-shaped handle 40. In yet another embodiment of this invention, the bolt 34 may have a handle 40 of any suitable shape that allows the bolt 34 to be inserted into the channel 32. In yet another embodiment of this invention, the stem 38 of the bolt 34 may be threaded.

As shown in Figure 3, in one embodiment of this invention, a reinforcement 36 may be attached on any side of the channel 32 that is adapted

to allow insertion of a bolt 34 into the channel 32. Such a reinforcement maintains the stability of the channel 32.

As shown in Figures 2 and 4, a hollow, elongated structure of the adaptor mechanism 16 may be equipped with one or more adjustable tripod pockets 42 adapted to secure the legs of a tripod 12, thereby mounting the tripod 12 to a storage vessel 14. As shown in Figure 4, an adjustable tripod pocket 42 may be comprised of a conduit 44 adapted to accommodate a hollow, elongated structure of an adaptor mechanism 16 according to one embodiment of the present invention. An adjustable tripod pocket may be further comprised of a pocket 46 attached to a conduit 44.

As shown in Figure 4, a conduit 44 is adapted to allow a hollow elongated structure of an adaptor mechanism 16 to pass therethrough. In a preferred embodiment of this invention, a conduit 44 may consist of an aluminum U-shaped structure having three straight sides in cross-section, which will accommodate an adaptor mechanism 16 having hollow, elongated structures that are square-shaped in cross-section. In one embodiment of this invention, at least one side of the conduit 44 is adapted to allow the insertion of a bolt 34 into the conduit 44. A reinforcement 36 may be attached on any side of the conduit 32 that is adapted to allow insertion of a bolt 34 into the conduit 32.

In a preferred embodiment of this invention, a pocket 46 adapted to receive and to anchor the legs of a tripod 12 may be attached to the conduit 44. In a preferred embodiment of this invention, the tripod 12 legs may be inserted into the pocket 46 and secured into the pocket 46 with a locking mechanism 45, such as a spring, a chain, or any other suitable means.

As shown in Figure 5, a retrieval system 10 according to one embodiment of this invention may also include a ladder 48. A ladder 48 according to one embodiment of this invention may be constructed of aluminum or any other suitable durable, but lightweight material. A ladder 48 according to one embodiment of this invention may be comprised of any number of steps 50, at least one handrail 52 along the side of the ladder 48, and a platform deck 54 on one end of the ladder 48. In one embodiment of this invention, the steps 50 on the ladder 48 may be equipped with stair tread to prevent loss of footing while descending the steps 50.

In one embodiment of this invention, the at least one handrail 52 may be attached to the ladder 48 with bolts, wing nuts, release pins, and base plates 56, as shown in Figure 6. Such attachment allows the at least one handrail 52 to fold toward the steps of the ladder during storage and transport. In yet another embodiment of this invention, the at least one handrail 52 is adapted to fold toward the steps 50 of the ladder 48 to ease storage and transport of the ladder 48. In a preferred embodiment of this invention, the ladder 48 is equipped with two handrails 52. In a preferred embodiment of this invention, the two handrails

52 are attached to the ladder 48 with base plates 56 having different heights, which will allow the two handrails 52 to fold onto each other during storage and transport.

In a method according to one embodiment of this invention, a rescuer may unfold the at least one handrail 52 of the ladder 48 and place the ladder 48 against a storage vessel 14 in which an individual is trapped. According to one embodiment of this invention, the rescuer may mount a storage vessel 14 and place the adaptor mechanism 16 onto a protective frame surrounding the storage vessel 14. According to one embodiment of this invention, the rescuer may place one hollow, elongated structure of an adaptor mechanism 16 on each side of an 18-20 inch inspection hatch of a storage vessel 14, parallel to the shortest members of the protective frame, as depicted in Figure 1.

As shown in Figure 1, in one embodiment of this invention, the rescuer may secure the adaptor mechanism 16 to the protective frame of the storage vessel 14 by sliding the adjustable mounts 28 along the hollow, elongated structures of the adaptor mechanism 16 until each adjustable mount 28 engages the protective frame of the storage vessel. In a preferred embodiment of this invention, the rescuer may adjust bolts 34 found in each adjustable mount 28 until the bolts 34 contact the hollow, elongated structures of the adaptor mechanism 16, thereby fastening the adaptor mechanism 16 to the protective frame of the storage vessel 14.

In a preferred embodiment of this invention, the rescuer may place a tripod 12 onto the adaptor mechanism 16, placing each leg of the tripod 12 into an adjustable tripod pocket 42 found on the hollow, elongated structures of the adaptor mechanism 16. In one embodiment of this invention, the height of the tripod 12 may be adjusted to accommodate retrieval of the trapped individual by sliding the adjustable tripod pockets 42 along the adaptor mechanism 16. In a preferred embodiment of this invention, the tripod 12 may be secured after the height is adjusted by adjusting bolts 34 found in the adjustable tripod pockets 42. In another embodiment of this invention, the tripod 12 may be further secured by placing a spring or a chain into the pocket 46 of the adjustable tripod pocket 42.

In one embodiment of this invention, the rescuer may use a winch 18 that is attached to the tripod 12 to unwind a tethering material 20, which has a hook 22 on its free end. According to one embodiment of this invention, the hook 22 may be attached to a harness worn by an individual trapped in a storage vessel 14 or other confined space. In a preferred embodiment, a winch 18 may be turned so that the tethering material 20 may be wound up through the pulley 24 and into the winch 18. As the tethering material 20 that is attached to a trapped individual by the hook 22 is wound up, the trapped individual is lifted out of the confined space or storage vessel 14. In a preferred embodiment of this invention, the rescuer may then assist the rescued individual down the steps of the ladder 48.

The foregoing description of this invention is made for illustrative purposes and enablement for those skilled in the art to practice the same. Many variations of this invention will become apparent because of the foregoing description but such variations do not depart from the scope and intent of the appended claims. As to any of the specific means described to perform specific functions in the practice of the described invention, other components which are equivalent in function may be substituted for those specifically described without departing from the scope of this invention.